

Remarks/Arguments

Claims 1, 3-4, and 7-9 are pending and under examination in this application. Claims 1, 3-4, and 7 are amended. Support for the amendment to claim 1 can be found in original claim 1 and the specification at [0046]-[0056]. Claim 3 has been reworded to be consistent with the wording of claim 1 and finds support in the same location in the specification. Claim 4 has been reworded to recite the steps of the claimed process more clearly, and also finds support in paragraphs [0026] and [0062], as well as original claims 5 and 6. No new matter has been added by this amendment.

Applicants believe these amendments place the claims in condition for allowance. However, to the extent they do not, no matter requiring further search or consideration is added by the amendments to the claims. Amended claim 1 recites spherical particles consisting of ferrite, as opposed to spherical ferrite particles. While the specification regularly uses the term “spherical ferrite particles,” it is clear from the disclosure surrounding the contents of those particles and the process of their manufacture that the spherical ferrite particles are “spherical particles consisting of ferrite” rather than merely spherical particles *comprising* ferrite. (See paragraphs [0046]-[0056] of the present specification) Any search for spherical ferrite particles would necessarily have turned up art disclosing spherical particles consisting of ferrite. Further, the Applicants have previously argued that the “spherical ferrite particles” recited in claim 1 do not include the particles taught by Hakata, and that Hakata only taught ferrite particles that were 100 times smaller than those recited in the preset claims; as such, this argument has already implicitly been considered by the Examiner. No further search or consideration is necessitated by the amendments to claim 1.

No further search is necessitated by the amendment to claim 4, either, since these amendments merely rephrase the claim such that each step of the process and the manner in which the step is carried out is presented in order in the claim. Further, though the step of “weighing” has been eliminated from the claim, it is clear that the step of mixing materials to make a ferrite is old and well-known in the prior art. Further, while the phrase “under fluidization” has been

added to replace the limitation stating “wherein the granules are made to flow by fluidizing means,” this would not require any further search or consideration by the Examiner, since the Examiner has considered any step that provides fluidization for the granules as a “fluidizing means.”

Interview Summary

The Applicants thank Examiner Zhang for taking the time to conduct an interview with Applicants’ representative on December 1, 2010. During the interview, the Applicants and Examiner discussed the rejections of claims 1, 3, and 9 over Hakata, and discussed the potential amendments to claim 1. Those potential amendments are presented in this filing. Further, the Applicants presented their argument that claim 4 was not anticipated or obvious over Hakata, and that claims 7 and 8 were not obvious over Hakata in view of Hultman or Kayamoto. The Examiner said that she would consider these arguments when they were presented in a filing.

Arguments

The Examiner rejects claims 1, 3, and 9 under 35 U.S.C. §102(b) as anticipated by Hakata, U.S. Patent 6,506,531 (“Hakata”). The Examiner, in the alternative, rejects claims 1, 3, and 9 under 35 U.S.C. §103(a) as obvious over Hakata.

Present claim 1 has been amended to recite the following:

A resin coated carrier for an electrophotographic developer characterized by comprising spherical particles **wherein said spherical particles consist of ferrite** and have an average particle size of 20 to 50 μm , a surface uniformity of 92 to 100%, an average sphericity of 1 to 1.3, and a sphericity standard deviation of 0.125 or less. (emphasis added)

The carrier disclosed by Hakata is a magnetic powder dispersed carrier including fine particles of an inorganic substance mixed with a binder resin. The fine particles of the inorganic substance may be spherical, but generally only have a

particle size in the range of 0.01-5.0 μm , and are preferably in the range of 0.1 to 2.0 μm . See Col. 4, I. 54-60. Only after treatment with a binder resin or coupling agent do the particles agglomerate together to reach a size of 10-50 μm . See, e.g. col. 6, I. 6-21. These particles are thus not *spherical particles consisting of ferrite*, since the particles have a component other than ferrite.

To the extent that spherical particles consisting of ferrite are disclosed at all by Hakata, the particles do not have an average size of 20 to 50 μm , but are instead *one to two orders of magnitude smaller*. This is borne out in the Examples. See, e.g., col. 15, I. 5-8 (“500 g of spherical magnetite particles having an average particle size (D_{av}) of 0.24 μm and carrying aluminum oxide at the surface and 500 g of hematite particles ($D_{av} = 0.4 \mu\text{m}$) were charged....”); Col. 15, I. 40-41 (“1000 g of spherical magnetite particles ($D_{av} = 0.31 \mu\text{m}$) was charged...”); col. 15, I. 64-66 (“A mixture of 800 g of spherical magnetite particles ($D_{av} = 0.31 \mu\text{m}$) and 200 g of hematite particles ($D_{av} = 0.60 \mu\text{m}$)...”); col. 16, I. 24-26 (“A mixture of 900 g of spherical magnetite particles ($D_{av} = 0.24 \mu\text{m}$) and 100 g titanium oxide particles ($D_{av} = 0.30 \mu\text{m}$)....”); Col. 16, I. 49-50 (“1000 g of polyhedral magnetite particles ($D_{av} = 0.26 \mu\text{m}$)....”).

Because Hakata does not disclose a resin coated carrier for an electrophotographic developer containing spherical particles consisting of ferrite, wherein such spherical particles have an average particle size of 20 μm to 50 μm , it cannot anticipate the invention of claim 1, or claim 3 that depends therefrom.

The Examiner points to Column 15, lines 30-37 as reciting a carrier core particle with a final diameter of 35 μm before the binder resin is added. Column 15, lines 5-37 describe the following process:

Into a Henschel mixer, 500 g of spherical magnetite particlesx having an average particle size (D_{av}) of 0.24 μm and carrying aluminum oxide on the surface and 500 g of hematite particles ($D_{av}=0.4\mu\text{m}$) were charged and sufficiently blended with each other, and to the blend under stirring, 7.5 g of a silane coupling agent having an epoxy group ... was added and mixed to surface treat the mixture oxide particles.

A 1 liter-flask was charged with 125 g of phenol, 187.5 g of 37%-formalin, 1 kg of the above-prepared surface-treated mixture oxide particles, 37.5 g of 25%-ammonia water and 125 g of water. The mixture was heated **under stirring** up to 85 °C. in 60 min., and then reacted for curing at that temperature for 120 min. to produce **composite particles** comprising a **phenolic resin and inorganic compound particles**.

Then, the content in the flask was cooled to 30 °C. and transferred to a 3-liter flask, to which 1.5 liter of water was added. After the supernatant liquid was removed, the precipitate in the lower layer was recovered, washed with water, and dried in air. The air-dried precipitate was further dried at 150-180 °C under a reduced pressure...to obtain **composite particles** (called hereinafter "**Carrier Core Particles A**").

Carrier Core Particles A were spherical particles (sphericity (ϕ_{sp} = 1.1) [sic] **comprising 44.0 wt. % of spherical magnetite particles** carrying aluminum oxide at the surface of **44.2 wt. % of hematite particles**, and exhibited $D_{av}=35\text{ }\mu\text{m}$, a specific gravity (ρ_{sq})=3.55, a magnetization of a 1000 oersted magnetic field (σ_{1000})= 29 Am²/kg, a residual magnetization (σ_r)=3.0 Am²/kg and a volume resistivity (R_v)= 1×10^{12} ohm.cm. (Emphasis added.)

From this description, four things become clear about Carrier Core Particles A:

- Carrier Core Particles A are **composite particles**, including spherical magnetite particles, hematite particles, and a phenolic resin;
- The phenolic resin comprises at least 11.8%, by weight, of Carrier Core Particles A, and at least 40% of the volume (see calculation on attached sheet);
- There is no reason to believe that all of the spherical ferrite particles and the hematite particles agglomerate into a single sphere surrounded by a coating of phenolic resin. Instead, because the phenolic resin is applied **under stirring**, it is reasonable to conclude that the spherical magnetite particles and hematite particles are dispersed throughout the phenolic resin, particularly given their small initial particle size (i.e., 0.24 μm for the magnetite particles and 0.4 μm for the hematite particles).
- The sphericity of Carrier Core Particles A refers to the **composite** resin-containing particles and *not* to the sphericity of the spherical magnetite particles or the hematite particles.

From these four facts, it is clear that Hakata does not anticipate or render obvious the present claims. The present claims recite *spherical particles consisting of ferrite* and having an average particle size of 20 to 50 μm and an average sphericity of 1 to 1.3. Carrier Core Particles A, as described by Hakata,

are **composite particles** comprising spherical magnetite particles with an average particle size of **0.24 µm** and hematite particles with an average particle size of **0.4 µm** (both **two orders of magnitude smaller** than the spherical ferrite particles recited in present claim 1) dispersed within a **phenolic resin**. Those **composite particles** have an average sphericity of 1.1.

Hakata is **silent** as to the average sphericity, sphericity standard deviation, and surface uniformity of the spherical magnetite particles or hematite particles used in forming the composite particles. As such, **not one single factor** of the spherical ferrite particles recited in present claim 1 is taught in Hakata.

The Examiner further argues that the properties, such as surface uniformity percent and sphericity standard deviation, rely on the process of forming the carrier, and not the components of the carrier. The Examiner also points to Example 1 of the present specification as teaching that the carriers are not solely ferrite and that they may contain additives. The Examiner says that because the carrier cores of the present invention and those in Hakata are made in a similar fashion, it is proper for the Office to assume that they have similar properties and that the burden is on the applicant to show that the properties are different.

First, the Examiner's ultimate conclusion is incorrect. A quick comparison of the processes outlined in the Examples in the present specification and the processes taught in Hakata show that the particles are *not* taught as formed by similar methods. A side by side comparison of the process described in Example 1 of the present specification and the teachings of Hakata is outlined in the following table:

Present Specification, Example 1	Hakata
Iron oxide (50 mol %), manganese oxide (40 mol %) and magnesium oxide (10 mol %) based on a total amount of oxides were weighed, mixed, and crushed to obtain a crushed material; thereafter water of 25 L was added to an attritor; and the crushed material was further crushed for 1 h to prepare a slurry	Hakata is silent as to how the spherical magnetite particles or hematite particles are obtained. The particles are never crushed.

of a solid content of 50%. The prepared slurry was granulated by a spray drier to obtain spherical granules.	
The granules were calcined in a rotary kiln at 900° C. After the calcination, 20 L of water, 128 g (10% solution of polyvinyl alcohol) of a binder and 100 g (ammonium polycarboxylate) of a dispersant were together crushed in an attritor for 2h to obtain a slurry having a solid content of 50%. The fabricated slurry was granulated by a spray drier to obtain spherical granules of 38 µm in average particle size.	Hakata does not describe any calcination step in a rotary kiln; no temperatures in excess of 180° C are ever applied to the material. The material described in Hakata is never spray-dried.
<p>The granules were pre-sintered in a rotary kiln at 700° C for 0.5 h to remove organic substances such as the binder. Then, the pre-sintered granules were fed to a rotary kiln whose hot section was set at 1,320 °C to further sinter for 1.5h. In the sintering, a nitrogen-mixed gas adjusted to an oxygen concentration of 4.5% is fed at a flow rate of 50 L/min to the rotary kiln. The operating conditions and the feeding amount of the ferrite granules are as follows:</p> <ul style="list-style-type: none"> • The retort rotation speed of the rotary kiln: 3 rpm/min • The retort inclination of the rotary kiln: 0.5° • The feeding amount of the ferrite granules to be sintered: 3 kg/h • The inlet hammering frequency: 30 times/min • The outlet hammering frequency: 20 times/min 	<p>Granules are never pre-sintered; in fact, an organic material (the phenolic resin) is applied during the process described in Hakata, and such a pre-sintering step would remove the phenolic resin.</p> <p>No sintering step is described in Hakata. No rotary kiln is ever used in the process described in Hakata. As such, Hakata is entirely silent as to the retort rotation speed, retort inclination, and feeding amount of the ferrite granules, inlet hammering frequency, and outlet hammering frequency.</p>
After the sintering, the obtained sintered material was shredded in a jet mill, and classified to obtain spherical ferrite particles of 35 µm in average particle size. The results obtained by the measurements described later of the physical properties such as shape and sphericity of the spherical ferrite particles are shown in Table 1.	No shredding step is described.

It is clear from the comparison of these two processes that they are highly different and result in highly different products. The steps of crushing, spray-drying, pre-sintering, sintering, and shredding used in Example 1 all serve to make smaller particles out of larger particles. In contrast, the steps described in Hakata all serve to make larger particles out of smaller ones. For the Office

properly to presume that the spherical ferrite particles recited in claim 1 and the composite particles described in Hakata to have similar properties, the Office must *first* show that the processes of producing both are similar. That burden has not been met here.

The Examiner also argues that the inclusion of other materials, such as manganese oxide and magnesium oxide in Example 1 show that the spherical ferrite particles can include other materials besides ferrites. Examining the specification, however, shows that the magnesium oxide and manganese oxide outlined in claim 1 are chemically combined with the iron oxide *to produce a ferrite* during the sintering step. For instance, paragraphs [0046]-[0048] of the present specification (referring to the pre-grant publication US 2007/0154833) state the following:

In a resin-coated carrier for an electrophotographic developer according to the present invention, the composition of spherical ferrite particles used as the carrier core material is not especially limited, but preferably is one expressed by the following formula (1):



Wherein $x+y+z= 100$ mol %, $x = 35$ to 45 mol %, $y=5$ to 15 mol %, $z = 40$ to 55 mol %.

Part of (MnO) and/or (MgO) in the above formula (1) may be substituted with at least one kind of oxides selected from SrO , Li_2O , CaO , TiO , CuO , ZnO , and NiO .

From this description, it is clear that the manganese oxide, magnesium oxide, and ferric oxide blended in Example 1 are sintered together to form *a ferrite*, out of which *spherical ferrite particles* are formed in Example 1 of the present specification. While other ferrite compositions can be used in making the invention, it is clear from the language of the claims that the spherical ferrite particles themselves have an average particle size of $20\text{ }\mu\text{m}$ to $50\text{ }\mu\text{m}$, and that the manganese oxide and magnesium oxide are thought of as part of the ferrite particles themselves. On this basis, there is no possible reason to conclude that the composite particles taught by Hakata in any way anticipate the present claims.

The Examiner argues, in the alternative, that claims 1, 3, and 9 are obvious. Applicants traverse this rejection as well.

Hakata teaches a magnetic carrier comprising composite particles, each comprising inorganic compound particles and a binder resin (see col. 2, l. 40-44). The carrier disclosed by Hakata is known in the art as a magnetic powder dispersed carrier, which is intended to be light-weight and have a low magnetic force. By dispersing the inorganic particles in a binder resin, one is able to generate long-lasting and high-quality images with the toner. The magnetic powder dispersed carrier according to Hakata is taught to generate an image with a longer life because of the light weight of the particles.

The magnetic powder dispersed carrier results in a longer-life image in part due to its lightweight carrier material. However, there are certain drawbacks. First, the lightweight carrier material makes control of image density difficult, in part due to the fact that magnetic powder dispersed carriers tend to have high electrical resistance. Second, because the magnetization is controlled by the quantity of inorganic particles dispersed in the matrix, balancing a consistent specific gravity, long image life, and other properties characteristic of image control can become difficult. Third, magnetic powder dispersed carriers can be easily broken by stress or agitation that occurs within the developer. Fourth, broken inorganic carrier particles may attach to a photoconductor and print to make a defective image.

Further, magnetic powder dispersed carriers have high residual magnetization and high coercive force; these result in inferior fluidity of the magnetic powder dispersed carrier. Specifically, when a magnetic brush is applied to the magnetic roll of a printer, the high residual magnetization and coercive force of the magnetic powder dispersed carrier may make the magnetic brush hard, which may result in a lower quality image. Further, the magnetic powder dispersed carrier may magnetically coagulate when separated from the magnetic roll, and will not be smoothly supplied in a mixture with a toner. The rapid increase in the charge in a toner will be obstructed, which may cause toner scattering and/or fogging, which will result in defects in the image.

The magnetic powder dispersed carrier taught in Hakata includes fine particles dispersed in a binder resin, which makes up a core material for coating with a binder resin. In contrast, the present invention recited in Claim 1 is a resin-coated carrier which includes a spherical particle consisting of ferrite as a core material, which is then coated with a resin.

As described above, the magnetic powder dispersed carrier taught in Hakata and the spherical ferrite carrier taught in the present invention have different core materials. One of ordinary skill in the art would not consider these materials to be similar. As such, though some properties may have overlapping values, any comparison between them is meaningless because Hakata teaches composite carrier core materials made by agglomerating smaller particles using a binding resin or coupling agent, whereas the present claims recite spherical ferrite particles made by crushing, granulating, and sintering larger particles.

Further, one of ordinary skill in the art would thus not be motivated to modify the magnetic particles described in Hakata to include larger spherical ferrite particles, because the magnetic particles described in Hakata are intentionally small in order to achieve longer image life and a high quality of image. One of ordinary skill in the art would thus not be motivated to make the magnetic particles bigger, and thus the electrophotographic carrier in claim 1, as well as the products recited in claims 3 and 9, which depend from claim 1, cannot be obvious over Hakata.

The Examiner has also rejected claims 4 and 7-9 under 35 U.S.C. §103(a) as unpatentable over Hakata in further view of Hultman, U.S. Pre-Grant Publication No. 2003/0177867 (“Hultman”). Applicants traverse.

Hultman discloses a production method for an iron-based powder. Claim 1 of Hultman recites the production method for an iron-based powder having a certain level of magnetic properties and electric properties; the iron-based powder comprises 0.5% by weight of silicon-containing iron and 10% by weight of an iron metal and/or iron alloy. Preferably, the iron-based starting material is magnetite and/or hematite, or another iron-containing compound, such as hydrated ferric oxides, goethite, ore lepidocrocite, or ferric salts. (Paragraph

[0015]). The method for producing this powder includes the steps of blending a powder containing iron and a powder containing silicon, followed by reduction at a temperature of 405 °C or more. The granules are then sintered, and in several examples the granules are sintered in a hydrogen atmosphere at temperatures below 1200 °C. See, e.g., paragraphs [0161], [0168], [0170].

Present claim 4 recites the following:

A process for producing a resin-coated carrier for an electrophotographic developer, the process comprising mixing ferrite raw materials, crushing the mixture, granulating the crushed mixture to produce granules, pre-sintering the granules at 500 to 700 °C, sintering the granules for 0.1 to 5 hours at a sintering temperature of 1200 to 1400°C under fluidization, and coating the sintered material, with a resin

As was shown above, Hakata teaches nothing approaching this process, beyond the step of weighing and mixing ferrite materials. Hakata specifically does not teach crushing the mixture, granulating the crushed materials to produce granules, pre-sintering the granules, sintering the granules, or coating the sintered material with a resin. Hakata merely teaches coating inorganic ferrite minerals (col 4., l. 31-53) with a coupling agent and/or a binding resin (see col.6, l. 31-42 and col. 8, l. 49-58) and is thus nearly irrelevant to whether this claim is obvious. Hakata, in fact, teaches away from the present invention, since sintering the composite particles produced by Hakata would serve only to burn off the organic resin or coupling agent during pre-sintering or sintering.

Hultman does not cure these deficiencies. Hultman does not teach or suggest sintering granules under fluidization. To date, the Office has identified no reason why one of ordinary skill in the art would modify the processes taught by Hultman or Hakata to include the step of **sintering the granules under fluidization.**

The present Office Action points to paragraph 0058 of Hultman as teaching that the carrier particles are subjected to a fluidized bed during sintering. This is incorrect. Paragraph 0058 of Hultman describes the following:

Furthermore, the as-reduced particulate material, which has optionally been subjected to an after treatment according to above, **might be coated or impregnated with a resinous material.** This

could be done in many ways, e.g. by dipping the material in a solution of such resinous material in a volatile organic solvent or by **spraying the resinous material over a fluidised bed of the particulate material** as known in the art. (Emphasis added).

This paragraph absolutely *does not* teach making the **sintering the granules under fluidization**. It instead teaches making the granules flow by fluidizing means **during coating with a resinous material**. The coating step is absolutely not the same as the sintering step. The sintering step as recited in claim 4 takes place at 1200 to 1400 °C, at which temperature any resinous material would burn off (organic materials will be removed from the particles at temperatures from 500 to 700 °C (see, e.g., Example 1 of the present specification, in which a pre-sintering step is applied to “remove organic substances”)).

Further, while Hultman states that the particles can be sintered at temperatures up to 1450 °C, the examples disclosed in Hultman only teach sintering at temperatures below 1200 °C, and thus teaches away from sintering the particles at a sintering temperature of 1200 °C to 1400 °C. As such, claim 4, and claims 7-8 that depend therefrom, cannot be obvious over Hakata in combination with Hultman.

The Examiner also rejects claims 7 and 8 under 35 U.S.C. § 103(a) as obvious over Hakata and Hultman, in further view of Mizutani et al., U.S. Pre Grant Publication No. 2005/0214671 (“the Mizutani ’671 publication”).

Applicants noted in the previous office action that the Mizutani ’671 publication is not prior art to the present application. The Mizutani ’671 publication was filed on October 13, 2004, which is slightly over a month prior to the filing of the present application, which was filed as a PCT Application on November 25, 2004. However, the Mizutani ’671 publication was filed **after** JP-03-424672, which was filed on December 22, 2003, to which the present application claims priority. Applicants submitted a translation of the priority document JP-03-424762, and a certification of such translation as accurate, along with the response mailed on April 1, 2010. The Examiner states that no such copy has been received.

Applicants are herewith resubmitting the translation and its certification as accurate. Support for claims 4 and 7 can be found in paragraphs [0029] through [0036] of the translated priority document. Support for claims 1 and 3 can be found in original claim 1 and 2, paragraphs [0017]-[0019], and the abstract. As such, the Mizutani '671 publication cannot be prior art to those claims under any section of 35 U.S.C. §102, as Applicants have sufficiently demonstrated that the claimed invention was made prior to the effective date of the Mizutani '671 publication. As such, claim 7 is not obvious over Hakata and Hultman because claim 4 is not obvious over Hakata and Hultman.

With regards to claim 8, the priority document does not teach the ranges of retort rotation speed, retort inclination, and inlet and outlet hammering frequencies of the rotary kiln. However, Mizutani et al. is silent as to the retort rotation speed, retort inclination, and inlet/outlet hammering frequencies; since Mizutani et al. does not teach that these are variables which are result-effective and may be optimized, and neither Hakata nor Hultman cure these deficiencies. Further, because claim 8 depends from claim 4, it is also not obvious over Hakata and Hultman. As such, claim 8 cannot be obvious over Mizutani, Hakata, and Hultman.

In view of the remarks, it is submitted that the present application is now in condition for allowance. Reconsideration and allowance of the pending claims are requested. The Director is authorized to charge any fees or overpayment to Deposit Account No. 02-2135.

Respectfully submitted,

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